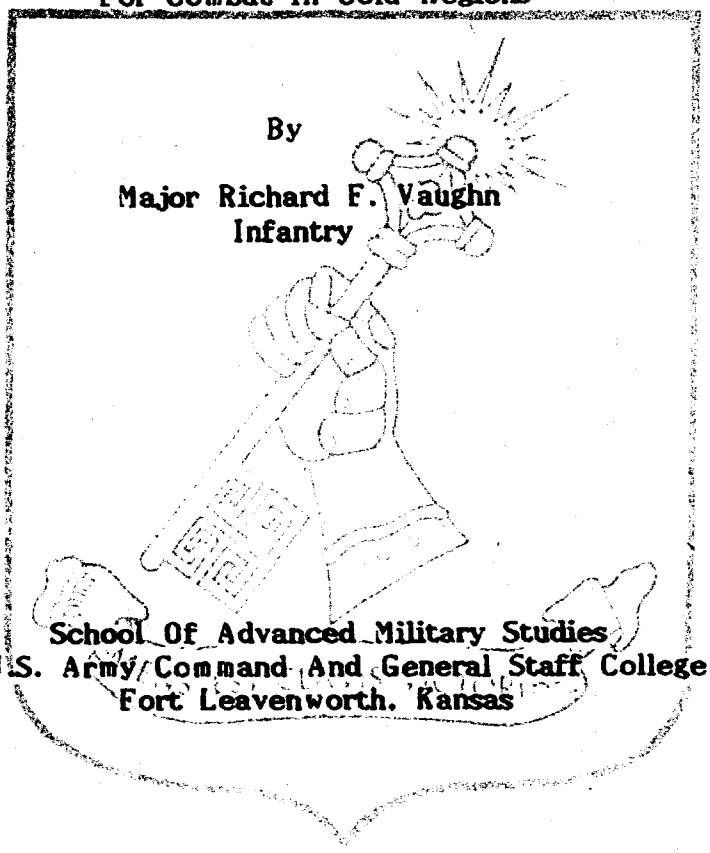
Cold Memories: An Examination Of U.S. Army Doctrine For Combat In Cold Regions



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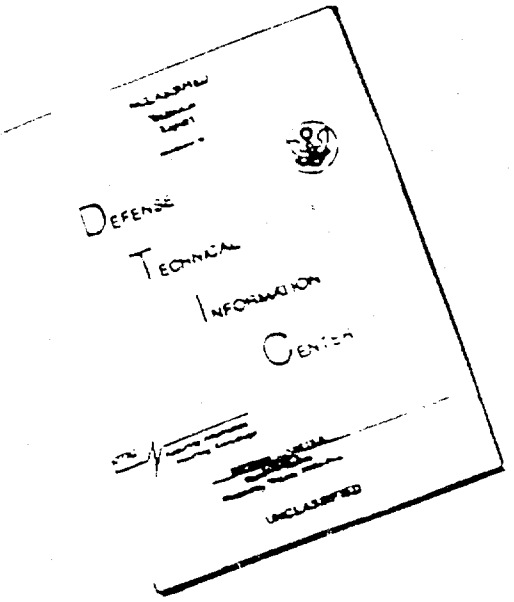

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This monograph examines the U.S. Army's need for a centrally-managed, detailed doctrine for combat in cold regions. It is important for the U.S. Army to maintain adequate doctrine for combat in cold regions. The Soviets are prepared to fight in the cold and have significant forces stationed in cold regions which challenge U.S. and Allied interests. The monograph determines if there are any gaps or deficiencies in our doctrine for cold weather operations; if units which have a stake in the doctrine and equipment developed for combat in the cold are sufficiently involved and prepared; and if an adequate institutional memory is beng maintained on cold weather issues.

Basic theoretical tactical concepts are addressed with respect to operations in the cold. The monograph then defines and describes cold regions and the effects of cold on personnel, equipment, and combat operations. Two historical combat case studies -- the Russo-Finnish War, 1939-1940, and the U.S. Army's Reconquest of Attu in 1943 -- provide insights into the needs for adequate doctrine for cold weather combat operations. Combat developments from WW II to today are examined, with brief histories given for primary agencies involved with cold weather operations, training, materiel development and testing, and doctrinal development. (continued on other side of form)

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The monograph concludes that there are several requirements for the U.S. Army's success in future operations in cold regions. Among these are: centrally-managed, detailed doctrine, maintained by one agency with adequate funds, personnel, and authority; amendment of current regulatory guidance for materiel developments to remove any ambiguities in defining requirements for cold weather function; immediate update or replacement of existing doctrinal field manuals for cold weather operations and support; accession and special management of personnel specially trained for cold weather and mountain operations; designation of specific duty position identifiers in unit TOEs for cold weather specialists; and the including of supplemental cold weather tasks by unit commanders in developing their Mission Essential Task Lists for training.

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ABSTRACT

COLD MEMORIES: AN EXAMINATION OF U.S. ARMY DOCTRINE FOR COMBAT IN COLD REGIONS by MAJ Richard F. Vaughn, USA, 47 pages.

This monograph examines the U.S. Army's need for a centrally-managed, detailed doctrine for combat in cold regions. It is important for the U.S. Army to maintain adequate doctrine for combat in cold regions. The Soviets are prepared to fight in the cold and have significant forces stationed in cold regions which challenge U.S. and Allied interests. The monograph determines if there are any gaps or deficiencies in our doctrine for cold weather operations; if units which have a stake in the doctrine and equipment developed for combat in the cold are sufficiently involved and prepared; and if an adequate institutional memory is beng maintained on cold weather issues.

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I - INTRODUCTION

"How can you expect a man who's warm to understand a man who's cold!"
Alexander Solzhenitsyn'

There are basically three components to military operations: soldiers, equipment, and environment. Of these, the environment is the factor over which an army has little, if any, influence or control. Therefore, an army must develop and use doctrine and equipment designed for success in the environment and for the preservation of its force[1]. Low, though, should an army develop proper doctrine and equipment for combat in *extreme* environments?

This monograph will answer the following question: Is there a requirement for maintaining a centrally-managed, detailed U.S. Army doctrine for conducting combat in cold regions, or should the issue remain a matter for units regionally deployed in, or with contingencies for, cold regions? It will also answer other related questions. Are there any deficiencies or gaps in the Army's definitions and doctrine for cold weather operations? Are units which have a stake in the doctrine and equipment developed for combat in the cold sufficiently involved and prepared? Is an institutional memory being maintained on cold weather issues or will the Army have to re-learn all the lessons learned previously during combat operations in the cold?

Additionally, this monograph will address the current state of U.S. Army doctrine for fighting in cold regions. It will define and describe cold regions and use historical examples to illustrate the impact of proper preparation for combat there. It will trace the history of U.S. Army doctrinal developments. Finally, this author will draw conclusions about the U.S. Army's doctrine for modern combat in the cold and determine if there are any pertinent implications for the future.

It is important that the U.S. Army remain ready to conduct combat operations in the cold. There are Army units in Alaska, Upstate New York, and the mountainous regions of Europe. Wartime contingencies for both forward-deployed and CONUS-based Army units call for deployment to cold areas. Thus, the Army should consider current doctrine and proper equipment for operating in the cold and preservation of the force as major combat developments issues.

II - MILITARY OPERATIONS IN EXTREME ENVIRONMENTS: THE THEORY

Theoreticians have not addressed operating in the cold as a distinct area of study. Instead, they have called for adaptating basic theories of warfare to special environmental or weather conditions. Early theoreticians, such as Clausewitz and Jomini, saw little need for considering warfare in the winter or the cold. Armies in their day, as a general rule, went into winter quarters to await the warm campaigning season. As Jomini stated in his work, *The Art Of War*:

> When winter approaches, the armies will either go into quarters, or the field will be kept by the army which has obtained decisive success and is desirous of profiting to the utmost by its superiority.[1]

Clausewitz considered the weather as an element of chance in his description of friction and chance in his treatise, *On War*. He stated:

> friction...is everywhere in contact with chance, and brings about effects that...are largely due to chance. One, for example, is the weather.[2]

Later in the same work, he described his thoughts on the impact of geography and terrain in terms of mobility, target acquisition, and protection:

> geography and the character of the ground bear a close and ever-present relation to warfare. They have a decisive influence on the engagement, both as to its course and to its planning and exploitation....The principal effect [of terrain] lies in the realm of tactics, but the outcome is a matter of strategy....Geography and ground can affect military operations in three ways: as an obstacle to the approach, as an impediment to visibility, and as cover from fire. All other properties can be traced back to these three.[3]

After the time of Clausewitz and Jomini, the only 19th-Century cultures maintaining significant populations or interests in cold regions were the Japanese, the Scandinavians, and the Russians. After the establishment of the Soviet Union, official doctrine reflected many valuable lessons learned in previous battles between the Imperial Russian Army and its recurrent antagonists: the Finns, Swedes, and Japanese.

The 1936 Field Regulations of the Red Army stated that properly protecting, training, and equipping the individual soldier gave an army the ability to carry out its operations in the cold effectively:

> Winter combat operations impose a special responsibility upon the commanders and rear services with respect to protecting personnel, maintaining health and combat activity of the

> soldiers, and ensuring optimum use of weapons and equipment....The mobility and maneuverability of the troops in winter depends entirely upon their training, their winter equipment, and the terrain of the winter battlefield. Troops not trained and insufficiently equipped for winter operations quickly lose their combat capability, and equipment not adapted for winter use only serves to become a burden to them. If such deficiencies are detected in the enemy, they must be resolutely and tirelessly used for his defeat.[4]

Today's U.S. Army appreciation of military operations in extreme environments is somewhat superficial. U.S. doctrine writers assume the risk that large-scale operations in cold regions will not occur in the near future. Field Manual (FM) 100-5, *Operations*, states:

> ...the likelihood is small that large forces will be committed to such an extreme environment. Nevertheless, the Army must be able to employ small combined arms forces in the arctic [sic] regions if required.[5]

Current U.S. Army doctrinal manuals specifically written for operating in the cold are considerably out of date. Field Manual (FM) 31-70, *Basic Cold Weather Manual*, detailing individual and small unit techniques, was last updated in 1969. Field Manual (FM) 31-71, *Northern Operations*, an outstanding manual for general tactical operations, carries a 1971 date. Field Manual (FM) 9-207, *Operation and Maintenance of Ordnance Materiel in Cold Weather (0° to -65°F)*, dated 1978, requires updating to reflect improvements in technology. The currency of manuals such as these could prove critical in the event of a modern threat in cold regions.

There is still a need for modern cold weather doctrine based on the threat. Chris Donnelly, a British scholar of Soviet military affairs, gives one likely scenario for this. He believes the Soviets will try to protect Murmansk by conducting tactical amphibious landings in Northern Norway in time of war. This will expand their capability to extend the air defense coverage of the Kola Peninsula and Murmansk. They will try to decoy much of NATO's effort to the north, weakening its Central Front[6].

NATO is only one area which is threatened. Since 1955, the Soviets have built up a substantial presence in the Siberian Peninsula[7]. According to one report, as of 1978, about one-third of the Soviet fleet and about one-fourth of their ground and tactical air forces are stationed in the Far East cold regions[8]. These could possibly be drawn into conflict with U.S. forces by adventurism on the part of the Soviet client state of North Korea.

The Soviet Army is prepared to fight in the extreme cold. They issue no special equipment to the troops for cold weather operations. Instead, they design their standard clothing and equipment for use in all environments. Their training and doctrine for fighting in the cold is thorough, based on their belief that they can win in winter[6].

III - COLD REGIONS

Definitions

How does one define the term cold regions? Ambient air temperature is the primary physical parameter associated with cold regions. It serves as a basis for describing their geographical aspects. The term Arctic is not sufficiently exact for use in describing them. While cold regions do include Arctic regions, they also include subarctic and other areas. The line encircling both the Arctic and subarctic regions circumscribes what is known in the scientific community as the 50°F temperature isotherm[1].

On a global scale, cold regions cover 20 per cent of the surface of the earth. They include Asian and European Russia, Canada, Scandinavia, Alaska, and the Iranian mountains. Cold regions terrain is generally characterized by marshes, lakes, boreal forests, and muskeg. The area has few roads and communications routes and is sparsely populated[2].

The U.S. Army accepts the 40° north parallel of latitude as the southern boundary of the cold regions in the Northern Hemisphere. It is interesting to note that the coldest portions of the Northern Hemisphere are not at the North Pole, nor are they exclusively above the Arctic Circle[3].

Army Regulation 70-38, *Research and Development, Test and Evaluation of Materiel for Extreme Climatic Conditions*, defines several categories of cold. *Intermediate cold* defines the operational range of temperatures between -5°F and -25°F. *Cold* defines the range between -35°F and -50°F. Lastly, *Extreme cold* defines the range between -60°F and -70°F[4]. The reader should note the 10° gaps between the temperature ranges defined here.

Temperature is not the only criterion used in describing cold regions. In northern latitudes, the large changes in the length of daylight periods result in corresponding changes in the amount of available solar radiation, a term known as *insolation*. As the days get shorter, and the insolation lessens, there is a

corresponding radiation loss from the ground surface. This factor combines with convection settling of dense cold air, and the trapping of the cold air by temperature inversions. These cause local concentrations of extremely low ambient air temperatures. Thus, short days can cause the subarctic regions of Siberia, Alaska, and Canada to produce the coldest temperatures on Earth[5].

Cold Regions Phenomena

The phenomena of cold regions are grouped into two principal classifications: weather and terrain. The weather offers challenges primarily through precipitation and cold temperatures. The terrain principally offers mobility challenges.

Weather

Perhaps the four most unusual weather phenomena in cold regions are ice fog, temperature inversion, whiteout, and blowing snow.

Ice fog forms at about -30°F when water passes from vapor directly into a solid, freezing around any particle available in the air. Since the absolute moisture content of the air at these low temperatures is so small, any moisture-producing source will cause ice fog. This includes gasoline and diesel engines, the combustion of propellants of small arms and heavy weapons, and the vapor trails from missiles. Ice fog limits the unit's ability to reduce its signature on the battlefield. Heavy weapons will obscure their own line of sight for second shots and reveal themselves to the enemy[6].

Often in cold regions, *temperature inversions* set in which can last for days. Temperature inversions cause warm air created by insolation to cool as it rises through cold air layers. Convection settling of the cooler air into low regions then occurs. As this temperature inversion lingers, air temperature may lower to the dew point, resulting in radiation fogs. As these become cooler, they form the ice fogs mentioned above[7].

Sometimes during a temperature inversion, solar radiation will warm the ground causing the inversion to rise 10 to 30 feet above the ground. Coupled with ground reflection of the sunlight off the snow, the sun's diffusion down through fog or clouds causes *whiteout.* Whiteout creates a loss of perception and degrades the ability to navigate. Drivers and pilots quickly tire and lose depth perception. Pilots have been known to lose their sense of the ground's location relative to

their craft and crash. Whiteout obviously impacts enormously on a unit's ability to conduct air assault operations[8].

Blowing snow can disrupt operations by its effects on equipment. Very fine particles of blown snow penetrate every crack or groove and melt on warm surfaces. Cold temperatures cause the melted snow to freeze and bind critical mechanisms. Blowing snow is the greatest visibility-limiting factor associated with ground operations[9].

Snow adversely affects mines, causing difficulties for countermobility plans in an already difficult region. Most costly to the obstacle plan is the snow's negation of blast effects. Scatterable mines delivered by helicopter may not arm if snow keeps the mine from striking the surface hard enough. Snow may blow over or away from minefields, exposing them. An unstable base caused by soft snow or tundra can cause mines to shift or tilt. Tilt rods can break. Trip wires can break from being brittle or they can be sufficiently covered by snow to be useless. Marking minefields may prove especially difficult in snow conditions and recovery may prove impossible. Burying mines in frozen ground may also be impossible, dictating strictly surface laying. Mines frozen to the ground after a brief thaw may require blowing in place rather than attempts at removal. The compression devices or mechanisms can experience thawing and freezing of snow, causing either no function or premature function. Electrically detonated Claymore mines may prove difficult to use, as the electrical leads may become brittle and break. Many of the mines require the soldier to remove his gloves in order to emplace or recover them, creating a danger of cold injury to the soldier's hands[10].

Terrain

Terrain varies greatly in cold regions depending on proximity to the coast, altitude, and latitude. There are, however, some characteristics which are common to most cold regions. There are many lakes and rivers. The regions present complex and abnormal patterns of steep-walled valleys, limiting approaches and crossing sites for streams and rivers. The systems of cross-compartments are complex, characterized by locally steep slopes. There are vast areas of taiga (boreal forest), and tundra (boggy arctic plains)[11].

In addition to the surface phenomena peculiar to cold regions, a subsurface phenomenon called permafrost has significant impact on operations. Permafrost is a layer of soil and ground moisture which remains frozen year-round. About one-half

of the combined land mass of Canada, the U.S., and the U.S.S.R. has permafrost beneath the upper layer of soil. Depth and thickness of permafrost vary with soil texture, temperature, precipitation, and topography. The frozen layer beneath the surface does not allow water to seep into the ground. Thin layers of soil over permafrost inhibit growth of large trees requiring deep roots. Thawing and freezing of the upper portion of permafrost cause the ground over it to heave and dip. This affects the stability of highways, bridges, and buildings constructed over permafrost[8].

Trafficability for cross-country and road movement is best in winter, even when one considers the special nature of moving over snow and ice. During the other seasons of breakup, summer, and freezeup, trafficability is worse. Permafrost's contribution to the vast expanses of standing water and bogs, and the many flowing water obstacles combine to make mobility the most significant problem encountered in cold regions[9]. In these other seasons, mud causes the largest mobility problem[4].

Mobility in winter requires special equipment for oversnow operations. Individual mobility requires skis, snowshoes, crampons, or snow machines (snowmobiles). Mobility for personnel, weapons, supplies, and equipment requires trucks, personnel carriers, or sled sets called ahkios. Wheeled vehicles are restricted to roads or specially prepared winter trails, made from digging out or packing down snow. Personnel and weapons carriers should be oversnow vehicles, but there are few of these currently in the U.S. Army. Ahkio groups are not restricted to any particular area, but the effort required by squads and sections in pulling them over the snow is demanding on the unit. Large scale unit operations therefore rely heavily on air transport and control of the limited road networks[6].

Historical examples show operations in which successful armed forces overcame mobility difficulties in the cold regions. The Finns in their fight with the Soviets in 1939 had little difficulty in moving soldiers over the battlefield. U.S. units today do not possess the oversnow capability of the Finns. Consequently, improvements in the technology for oversnow vehicles and other equipment have become important for success[6].

Effects Of Cold Regions Phenomena On Materiel

Cold effects on equipment require special attention by the materiel developers and the users. A clear understanding of cold regions phenomena is a prerequisite for development and use of equipment in the cold. Phenomena have different effects on different items.

Storage battery efficiency, for example, drops when exposed to low temperatures. Charging is especially difficult. The cold, therefore, threatens any high-technology item requiring a battery".

Electronic devices and components respond well in the cold. They do, however, require care. Solid state components require less attention than mechanically manipulated components, but require longer warm-up periods at low power before operation. Mechanically manipulated components respond better to the cold if the materials used in their construction are compatible and similar in reaction to the cold. They also require proper lubrication".

Conventional engine lubricants (mineral-based) have proven to be unsuited for cold weather operations. They harden and hinder engine starting below freezing. New synthetic lubricants are better for operations in the cold".

Different materials used in manufacturing experience different effects from exposure to cold. Some metals become brittle at low temperatures. While their tensile strengths may increase with lower temperatures, their resistances to shock loading or impact may actually decrease". Plastics lose resistance to impact and lose strength as temperature decreases". Rubber experiences very gradual crystallization, loss in resilience, and an increase in stiffness and hardness. Rubber hoses used for fuel, hydraulic fluids, oils, and lubricants deteriorate faster than those for other materials. This is due to the chemical reactions induced by these fluids in rubber in the cold. Rubber tires may develop flat spots and settle out of round if vehicles remain stationary for long times at low temperatures".

The Army must develop materiel items which can withstand the cold or, if they are available, purchase them off-the-shelf. In the past, the Army materiel developers have adapted materiel items originally developed for use in temperate or hot zones and used them in the cold. They have very often given unsatisfactory results at Army test facilities. Today, technology and research are producing new products and ideas that can assist in developing items specifically designed to overcome cold effects, allowing for successful military operations while minimizing the effects of prolonged cold on personnel.

Effects Of Cold Regions Phenomena On Personnel

Physical Effects

Combat experiences have shown that knowledge and training contribute directly to the extent to which the cold affects soldiers physically. The skills which best serve the soldier in this environment are those concerning regulation of body heat production and body heat loss. Heat production comes from the soldier's eating, drinking, daily hygiene measures, and his own particular body metabolism. He increases heat production by eating and exercising more. He controls his heat loss by dressing appropriately, using heated shelter, or pacing himself while operating out in the cold environment. Both heat production and heat loss relate to the maintenance of his body *core*. The core is that portion of the body in which the body temperature does not drop as rapidly or as much as the skin temperature. The soldier has control of all of the factors contributing to heat production and loss in the core except those relating to his own peculiar metabolism. Thus, he must be aware of his own capabilities, limitations, and requirements in the cold, especially when he chooses clothing[23].

Appropriate clothing with sufficient space for trapping dead air is very important in the reduction of body heat loss. The trapped air must remain immobile to retain the body heat, while allowing for freedom of movement and dissipation of moisture. The trade-off between warmth and adequate mobility or dexterity allowed by the clothing must be examined with respect to the soldier's body extremities, such as fingers and toes. These extremities are farthest from the body core and are subject to heat loss more quickly than other parts of the body. They require dexterity and flexibility in conducting military tasks, necessitating less bulk in outer insulation. Soldiers and leaders must balance the requirements of mission accomplishment and preserving adequate warmth for the soldier's safety. Each soldier's clothing requirement will vary with his metabolism and work level. Thus, there is no such thing as the *average* soldier; so one uniform dress for all will not be appropriate for the best performance by unit members[24].

The effect of acclimatization of soldiers can act as a combat multiplier. An acclimatized soldier maintains a lower metabolism. His body more readily adjusts to the heat loss. He maintains a smaller body core. Thus, he is better able to

store heat reserves and operate in the cold over longer periods. Acclimatization offers the soldier several other advantages. He endures stress better. He requires less exercise to keep him from shivering. His circulation is better, especially in his extremities. This enhances his dexterity and reduces the danger of cold injury[25].

Cold injuries can affect the whole body or local areas. Whole body cooling, or hypothermia, results when the body's overall heat loss rate exceeds its heat production rate. Local cold injuries include frostbite, trenchfoot, chillblain, and immersion foot. These result from heat loss or inadequate care of extremities. While local injuries can lead to loss or degradation of the extremities, hypothermia can be deadly. Clean, adequate clothing, which traps warm air better, and supervised daily hygiene, allowing soldiers to check each other for symptoms, can limit the effects of cold injuries. Training and experience, however, serve best to ward off the occurrences of cold injuries[26].

Besides causing cold injuries, temperature and snow lead to other adverse physical effects on soldiers. Dehydration results from the soldier's exertions in the cold, requiring leaders to check that their soldiers are drinking enough water. Sunburn results from reflection of solar radiation off the snow and ice. Snow blindness occurs when soldiers fail to use sunglasses to lessen the effects of reflected light off of snow and ice[27].

Psychological Effects

Humans respond psychologically to the cold regions in a variety of ways. The psychological factors prevailing in the cold are lower morale, isolation, disorientation, and reduced social interaction[28].

Winter operations in cold regions can cause psychological adjustment problems, seriously affecting morale. Tests have shown that these problems of adjustment lead to lack of motivation, insomnia, depression, and dissatisfaction. Over longer periods, scientists document such behavior patterns as conceit, jealousy, excitability, and suspicion[29].

Just the idea of isolation can cause people to react negatively to the cold regions. When operations stop during extreme cold, feelings of anxiety and isolation develop. Since these operations are characteristically conducted in remote areas, these feelings grow. Feelings of isolation can contribute to an irrational fear of the cold in untrained soldiers[30].

Disorientation also contributes to psychological stress. Spacious areas of tundra and wilderness do not offer many landmarks. In dense taiga, visibility is extremely limited. Few contour lines on maps, a lack of contrast, and an absence of man-made objects in aerial imagery complicate locating reference points. Heavy snow may cover roads, trails, and other landmarks. Whiteout will often obscure the horizon and hide terrain relief patterns. Thus, one can expect the stress caused by these phenomena to be a significant factor in military operations[21].

Problems of social interaction can be overcome by good unit cohesion and leaders who are good motivators. If the motivation to achieve a group goal is high, then the individuals in the group feel less frustration and stress. Team cohesion and a high state of training readiness help to reduce the stresses on the members of the group. Leaders must, however, be alert for those in the group who can not respond well to the demands of the cold regions. They must realize that knowing their people, and conditioning and training them well prior to conducting operations in the cold leads to better psychological preparation[22].

Sleep can assist leaders in getting their soldiers out of the pessimistic lethargy brought on by the stresses of the cold environment. Leaders must still, however, set examples of aggressiveness and require the same from their subordinates. The men must keep busy so that exercise can be used to generate warmth in their body cores. Group chores will bring soldiers into constant contact with each other, relieving the feelings of isolation prevailing in the cold regions[23].

Strong individual leadership and the development of a sense of group responsibility can solve most of the psychological problems involved with military operations in the cold. Once he meets the needs of the individual soldiers, the leader can readily consider the more detailed operational requirements of missions in the cold.

Effects Of Cold Regions Phenomena On Military Operations

General

There are several interrelated factors contributing to the difficulty of military operations in cold regions. Foremost among these are the hostile climate, formidable terrain, extensive water and ice obstacles, and their accompanying trafficability problems. Massive distances, poor lines of communication, low

population densities, and an accompanying lack of shelter and developed resources compound the problems a military force can expect. It is tempting to say that no armed force could successfully operate in the face of these conditions. History proves, however, that armed forces can and do operate in cold regions and must plan for future operations there. While there are significant population centers in the cold regions, great distances often separate them and wilderness surrounds them. The infrastructure of roads, airfields, railroads, and industrial centers becomes critical to the planning of large scale operations. With such a sparse population, host nation support for labor, transport, shelter, and communications is equally sparse[24].

Operational Considerations

In order to employ combat power successfully, an armed force requires intelligence of the capabilities, vulnerabilities, and likely actions of the enemy. Equally important is the requirement for intelligence about the environment in which the force will be operating. Considerations about the environment's impact will center on its influence on the method and direction of attack, and the capabilities of the soldiers and equipment to perform while exposed to it[25].

Intelligence summaries on operational areas normally reflect statistical means when describing environmental effects. Unfortunately, means will not adequately prepare a force deployed in the hostile, cold regions for the rapid, dramatic local changes in the weather experienced there. The commander's specific intelligence needs will probably best be provided by local inhabitants or specialized groups, trained and experienced in the region[26]. When inclement weather grounded the air assets during a 1965 joint strategic mobility exercise, intelligence dropped to almost nothing. Thus, a well-rounded intelligence system that can continue in the face of the loss of one medium of collection is essential[27].

Cover and concealment take on new dimensions in cold regions. Target acquisition depends largely on the amount of camouflage used. Snow in the winter calls for white camouflage. Ice fog generated by running vehicles mandates care in positioning in order to reduce the signature[28].

Units will probably fight major engagements in the cold regions for possession of routes and supply lines. Historical accounts of operations by the Russians, Finns, and Germans support this observation. Since independent task forces will probably perform these predicted engagements, open flanks will be routine, and the risk of envelopment high[38].

In 1964, Combat Developments Agency, Alaska (CDA [AK]), developed a general concept for small scale northern operations. The ideal force for these types of missions had several characteristics: relatively small size considering the area it covers; equipped with full cross-country mobility for *all* elements, not just combat elements; and containing mobile direct support logistic elements. The ideal size recommended for these types of operations was a battalion or brigade task force with combat support, and mobile combat service support elements *attached* rather than *supporting*. This force was to receive allocation of enough aircraft to support and/or sustain operations over large distances[40].

The findings by CDA (AK) supported those of an earlier study conducted in 1962 by The Arctic Institute of North America. The AINA estimated that Army battle groups larger than company size could not be adequately sustained without massive airlift. They did not believe that a group as large as a battalion could remain mobile in the field in mid-winter sheltered only by semi-permanent tenting. Supplied by the vehicles available in the era of the early 1960s, they estimated that 200 miles was the maximum distance from a support base that the force could operate. Additionally, operating at that distance, they estimated that the demands of the force would probably exceed the capabilities of the logistical system[41].

In addition to the problems of tailoring a supportable force, commanders must recognize the slower pace of operations in the cold. Operations require more time due to the many associated survival and maintenance tasks. Acclimatization of soldiers and units will help, but commanders must be alert for an acclimatized enemy who gets an early start on the operation[42].

Trailmaking in the undeveloped regions of the north becomes a crucial requirement in order to conduct operations, supply units, and evacuate wounded. Trails become important when planning for commitment of reserves or counterattack forces[43]. In any offensive, trailbreaking begins as soon as units receive the orders. This includes cutting brush below the snow line to facilitate skiing and the pulling of ahkios. An estimated one-fourth of the unit could be breaking trail

at any one time. Therefore, for a brigade-size attack, one battalion task force can be expected to be breaking trail. This will allow for the troops in the attack to arrive in a state other than sheer exhaustion. Further, a brigade attack will probably require three trails, with the trailbreaking parties departing in advance of the main body by a time factor of one hour for every five kilometers to be cleared[44].

With the restrictions of ground mobility in the cold regions, the U.S. relies heavily on air transport for movement and supply in order to maintain tactical momentum. Momentum is difficult to achieve because of the limited mobility of the region and the requirement to rest troops frequently. Once momentum is gained, it is easily lost. Lines of communication become so vital in the cold region that commitment of as many troops to route maintenance, supply, and evacuation as are fighting may not be uncommon[45].

With or without trails, moving units rapidly offers a challenge for leadership and judgement. During Exercise WILLOW FREEZE in 1962, soldiers of Company E, 187th Airborne Battle Group, attempted to carry only essentials for combat in their rucksacks. These weighed about 68 pounds per man. By doing this they cut out about 100 pounds per rucksack of essentials for survival. After a very short time, the trade-off of survival gear for purely combat gear took its toll. The unit was withdrawn from the exercise as combat ineffective. The lesson here is that survival gear is as important as combat equipment. Moving between 1/2 and one mile per hour for eight to ten hours, carrying his rucksack and weapon, and pulling an ahkio sled with his shelter, food, and heating materials, the soldier is too exhausted to perform combat tasks. The stress of combat adds to the problem. He needs a tracked oversnow vehicle to bring forward some of the load[46].

Combat Service Support Considerations

There are three aspects of the cold regions which affect logistical planning and support efforts: the nature of the hostile environment, to include the weather and terrain; the increased time requirement for successful logistical support; and the increased scale of support required. Successful operations may require either delivery or prepositioning of over one and one-third short tons of supplies per month per soldier[47]. Combat service support units will find that they must have cross-country movement capability on par with or exceeding the movement capability of the supported units[48].

In the final report of Exercise POLAR STRIKE, held in the winter of 1965, the Commander, USARAL, recommended that exercises in the future stress the logistical planning, execution, and impact for units operating in the cold regions. He believed that the major military problems facing units in cold regions were the problems of supply, medical, and maintenance support[48].

Maintenance in cold environment takes considerably longer than in the temperate zone. Some estimates place it at five times as long. This should emphasize rather than detract from its importance! Isolated units will depend on proper maintenance of equipment for their survival. Priorities for maintenance will require careful planning so the right items are prepared at the right time, while allowing for proper rest for the operators and mechanics. Shelter for maintenance operations will be mandatory in order to perform them adequately[50].

Shelter, so essential to successful cold weather operations, must be properly designed for the purpose. Improper shelters, such as tents without proper liners or weather seals, do not provide sufficient warmth. They waste precious fuel in vain attempts to warm them, and take up transport space better used to carry other items. In short, they are a liability rather than a benefit[51].

Storage requires special consideration also. Dry storage should be on dunnage and under shelter. Cold storage will not be a problem for some items, but special items like medicines will still require carefully controlled temperatures. Units must not leave small items of supply on the ground or they will be lost in the snow[52].

Tactical situations in the cold regions will require highly mobile medical facilities. This requires tracked vehicles to move facilities and evacuate wounded in warmth, protected from the elements[53].

Leadership Considerations

The leaders of successful units must endure the same difficulties as their soldiers. When a leader maintains close associations with his subordinates in cold situations, his weaknesses in personality and emotional structure are magnified. One of his most valuable assets will be his own internal gauge to tell him when he needs to separate himself periodically from his men to reflect on his behavior within his command[54].

Operating in the cold places special leadership requirements on units. Every leader in the unit must have the proper knowledge and skills to operate in the cold, plus the commitment to the mission which is so essential in helping soldiers

overcome their fear of the environment. The leaders must actively work to build soldiers' confidence in their training and equipment. They must pay extra attention to detail when planning and executing operations in the cold. Leaders must have the courage to establish top-to-bottom leadership strength among the soldiers; each soldier must share part of the responsibility for the unit's well-being. Each member must feel the responsibility for checking other members of his squad or team for symptoms of the physical or psychological effects of the cold. Each man must conduct proper maintenance on his own and unit equipment[55].

The following two chapters illustrate how the leadership, training, and the equipping of the fighting forces have been the keys to success of combat units in the cold. This will be depicted in two historical examples: one, a victory within a defeat; the other, a defeat within a victory.

IV - RUSSO-FINNISH WAR, 1939-1940

General Account of Events

The Czar of Russia had ordered the Finnish Army to disband at the start of the 20th Century. His downfall after the 1917 Russian Revolution removed this limitation on the Finns. Out of an internal dispute and victory over the Finnish Bolsheviks, the Finnish Army was reborn. Training began with basic combat skills, then progressed to winter warfare skills. In 1925, the Army added training in military skiing to its instruction for winter warfare. The ahkio sled, long a useful tool in the interior, was militarized. The Army also performed many tests in the development of a tent system that came to be the envy and the model for many other armies, and would prove invaluable in the coming fight with the Soviets'.

The Protective Corps, which had its roots as far back as 1100 under the Swedish domination of Finland, was the foundation of the Finnish Army that fought the Soviets in 1939-40. Since the early 1920s, the Army had encouraged civilian skiing competitions and military ski training in all of the Protective Corps districts of Finland. Biathlon competitions (ski and shoot) were added to the programs in 1925, along with orienteering, both of which helped build physical stamina and endurance. Protective Corps boys' detachments, similar to Boy Scouts, began forming just before 1930. These youths practiced skiing, shooting, and camouflage skills. Thus, the Finns had prepared well for winter warfare in northern Europe[9].

The Soviet Army, on the other hand, was not properly prepared for war on the Finnish Front. Their failure to prepare properly for cold-related problems caused them thousands of casualties. Not only did they not have adequate equipment, but the majority of Soviet soldiers who crossed the frontier in 1939 wore khaki uniforms. The leaders, sure of quick victory, did not even call for vehicles and equipment to be camouflaged[3].

The Soviets believed that the offensive spirit which pervaded the Red Army would carry them to easy victory. Their poorly trained officers adhered strictly to regulatory battle drills, even in the face of needs for adaptation. Tactics were, therefore, mass tactics. Eventually, the Soviet ability to draw on wave after wave of Soviet soldiers from the large population base defeated the Finns. Thus, the war was won by attrition, but only after the Finns taught the Soviets many lessons about fighting in the cold[4].

The Finns' early recognition that the Soviets remained near the roads gave them a basis for their tactics. They conducted extensive reconnaissance aimed at finding trains locations. Once the Finns located the trains containing the Soviet field kitchens and shelter, they mounted raids using highly mobile ski-mounted battalions. Without these trains, the Soviet advances came to a halt. The Finns then isolated elements in the columns and destroyed them in small increments.

The Soviets' lack of oversnow movement capability held them close to the roads. Even though they had many ski sets available, they had no training in their use. Thus, the Soviets rarely ventured more than 400 meters from the main roads[5]. The message is clear that combat units must have oversnow capability at least equal to that of the expected enemy force.

The Finns, in contrast to their enemy, traveled easily through the snow and forests and protected their forces from the elements. They used light equipment and acclimatized soldiers who were well-trained in skiing, snowshoeing, and other methods of cross-country movement in the cold regions. They made winter roads, called *talvitie*, through the snow and over frozen bodies of water, using horse-drawn snow plows. These roads allowed them to supply their forces and evacuate their wounded. For shelter, they used squad-size tents called *joukkotelta*, warmed by small stoves burning birch wood. Troops rotated out of combat every two hours to warm themselves in the tents[6].

Because the inadequate preparations and other unforeseen difficulties were not producing a quick Soviet victory, Stalin was furious. He fired Marshal Voroshilov as Commissar for Defense, replacing him with Timoshenko. He made Timoshenko Commander-in-Chief of Red forces in the Finnish theater. Providing the Soviet forces with new political officers and fresh supplies, Timoshenko resumed the offensive and pressed until both sides signed a cease-fire agreement on 12 March 1940[7].

In the end, the Finns lost 23,157 killed and 43,557 wounded. The Soviets lost almost 10 times those numbers, but they did not feel the impact as much as less-populous Finland[8]. Other significant casualties of this war were the old ideas in the Soviet Red Army about combat in the cold. To discuss these and other lessons learned from the Winter War, a special meeting was held in the Kremlin between 14-17 April 1940 to discuss the campaign in Finland. Critics stated that the poor showing by the Red Army was attributable to several key factors: inappropriate force structure for infantry divisions; poor state of training at the individual soldier level; lack of infantry firepower; shortage of oversnow mobility means and winter clothing; lack of winter warfare training; and difficulties in the supply and maintenance systems. Many reforms came out of this meeting which left the Red Army in good stead in preparation for the war with Germany in the following years[9].

One of the major battles in Finland studied by the Soviets, and later by the U.S., was the battle of Suomassalmi. The following section describes the events of that battle.

Victory at Suomassalmi

In December 1939, the Soviet Ninth Army attacked westward into Finland to bisect the country at its narrow waist, sending the 44th Motorized Infantry Division and the 163d Infantry Division as the elements to accomplish this task. The 163d had reached the hamlet of Suomassalmi, 25 miles from the Soviet border and 100 miles south of the Arctic Circle, by 7 December. The snow there was as deep as three feet over the countryside, and the temperatures dropped to -30°F and colder. By Christmas, a Finnish division hastily organized from three *jager* regiments (light infantry, of which two regiments were reservists) began to counterattack against the 163d. After two days of fierce fighting, the Soviet division disintegrated and was routed back to the Soviet frontier. The Finns now

concentrated on the 44th Motorized Division, a Ukrainian division, approaching Suomassalmi from the southeast along the one available road[11].

The Finns had established a roadblock to slow the progress of the Soviet 44th Division and keep it from linking up with the 163d Division. Because of the roadbound operations of the 44th, and the lack of experience in cold weather operations among the Ukrainians from the plains, two Finnish companies and some mortars proved capable of completely stopping the Soviet Division.

The 44th Division's 50 tanks and its troops, who were not even trained sufficiently to don their allocation of 200 pairs of skis, did not venture more than a few hundred meters from the road. The highly mobile Finns were able to move at will around the Soviet formations and conduct extensive reconnaissance. The Finnish division was constructing a winter snow road to support a major attack against the helplessly immobile 44th. Later, the Finnish commander ordered another winter road built around the 44th. These winter roads allowed for harassing attacks and, finally, a major attack as deep as 15 miles past the roadblock along the Soviet column[11].

By the end of December, the Soviet Commander of the 44th Division ordered his units to dig in and defend. His soldiers had no portable shelters, so many of them built lean-to shelters or snow holes. Many froze to death in their sleep. Estimates placed nonbattle casualties due to cold as high as battle casualties. The Finnish probes made even the lighting of warming fires too dangerous. In contrast, the Finnish combat units hauled 20-man tents on ahkio sleds. These tents had small, wood-burning stoves, which allowed rest periods for the Finnish soldiers in relative warmth.

Once the Finnish attacks began in earnest, the winter roads were extended to points immediately behind the battle areas. Here, the Finns had hot food and drinks prepared in warm shelters. The troops not in immediate contact, as indicated earlier, rotated into these tents about every two hours[12].

In contrast to the well-supplied and warm Finns, the Soviets were hungry and cold. Their morale began to bottom out very quickly. The Finns had deliberately made Soviet field kitchens high priority targets, gradually destroying or capturing all 55 of the ones deployed by the Soviets. On 4 January, the Finns began attacks in strength against the 44th Division. By late on the 6th of January, the 44th Division Commander ordered a general retreat, authorizing subordinates to exfiltrate back to the frontier. The Finns were able to capture 43 of the 44th

Division's tanks, 70 field guns, 278 other vehicles, 300 machineguns, 6,000 rifles, and 1,170 live draught horses. They estimated Soviet losses in this action at 22,500, while losing only about 2,700. The Soviet 44th Division commander escaped, only to be shot upon his return to the U.S.S.R."

The primary conclusions drawn from examining the Battle of Suomassalmi concern mobility, equipment, training, and protection of the soldiers.

Mobility difficulties in the terrain of the far north hinder the ability to mass large formations. Winter favors the offense more than any other season in this region. The Finns' building of winter roads to overcome mobility problems directly supported the front line troops. Where there were no roads, Finnish oversnow movement techniques proved to be invaluable, especially in the area of reconnaissance.

Proper equipment and clothing for the soldier, to include overwhites for camouflage, protected and concealed the Finnish troops in the snow and cold.

Individual training, especially Finnish ski training, was a major key to tactical success. The best lesson to come out of the war was the one about sled-portable tent and stove groups to provide warm shelter for the troops, thus prolonging their ability to sustain combat operations.

V - RECONQUEST OF ATTU, 1943

Attu, located about 2,000 miles from Juneau, Alaska, in the Aleutians, is the only inhabited island of North America lying within the Eastern Hemisphere. The local inhabitants and veterans of the 1943 battle on Attu claim that it has the world's worst weather. Constant winds reach speeds as high as 140 miles per hour, and fog shrouds most of the island, in spite of the high winds. In describing the terrain, local inhabitants indicate there are no trees because the constant winds will not allow them to take root. The ground is covered by combinations of tundra, matted grasses over volcanic topsoil, and muskeg. Tundra is not trafficable for tanks, jeeps, or landing aircraft. The mud is thick enough to pull the boots off a walking soldier'.

On the morning of 7 June 1942, 2,500 naval infantrymen of the Japanese Imperial Northern Fleet landed unopposed on several islands in the Aleutians[3]. On 29 October 1942, a battalion of Japanese infantry landed in Holtz Bay on Attu[3]. In all, there were about 2,600 Japanese on Attu by the time U.S. forces began landings six months later.

In early 1943, the Army chose the 7th Motorized Division to retake the Aleutian islands of Kiska and Attu. This unit was, until that time, training in the California desert for use in North Africa. Against protests by commanders in Alaska, the 7th was diverted for use in the Aleutians. The Army had no real experience in conducting amphibious island fighting. Still, the War Department gave the 7th only three months to transition from a motorized desert force to an amphibious Arctic force.

During the preparation for departure from San Diego, experienced officers from Alaska tried to emphasize the requirements for the campaign. The critical requirements were supply and fire support. After weeks of arguing, authorities supplied 105mm howitzers to the division to replace the 75mm pack howitzer normally used by the 7th. Staff officers ridiculed an estimate that every *one* combat soldier needed *two* soldiers to keep him supplied in the undeveloped terrain. Adding to the problem was the overall supply situation. The Army's supply of winter clothing and equipment was in England and Africa in preparation for the invasion and campaign in Italy[4].

The 7th had no place to practice landings on terrain similar to Attu. All they had were the beaches of San Clemente Island and Monterey in California[5]. In an effort to protect the secrecy of the coming mission, the men of the 7th received short-sleeved tropical uniforms and classes on tropical diseases. Thus, the individual soldiers received no real environmental training preparation for operating in the cold. On 24 April 1943, the assault force set sail from California in five overcrowded ships, unaware that the environment was to be a worse enemy than the Japanese[6].

Upon arriving at Cold Bay, Alaska, the 7th Division did not take the opportunity to acclimatize the men. There were no facilities ashore and the ships provided the only warmth. The only unit to try to train and acclimatize was the Provisional Scout Battalion, who used the week in harbor to practice ashore[7].

The Provisional Scout Battalion had formed under command of Captain William H. Willoughby. Willoughby created this unit of 410 hand-picked officers and men by recruiting from all over the 7th Division and Fort Ord area. The Scouts were physically tough and able to march over mountains carrying full packs with little effort[9].

The plan of attack on Attu called for landings of one regiment at Holtz Bay in the north, one regiment at Massacre Bay in the southeast, and Willoughby's Scouts in the west. These forces would link up in the mountain pass separating them and move northeast to destroy the supposedly cut-off Japanese garrison in Chichagof Harbor. The third divisional regiment would remain on board ship as a reserve force. On 3 May 1943, radio intercepts revealed that the Japanese had discovered the plan for the invasion of Attu. The garrison was on 24 hour stand-by alert[9].

Storms in the islands caused postponements of the landing. Secrecy, stressed since before leaving California, was so poor that a Walter Winchell broadcast during the week before the landing advised the world to watch the Aleutians. In preparation for the expected invasion, the Japanese commander moved his troops away from the coast. Knowing the difficulties involved with trafficability on the island, he wanted to fight the invaders in the hills, as far from the supplies on the beaches as possible. On 11 May, the U.S. Army conducted its first amphibious island landing in history unopposed[10].

By 1700 hours on D-Day, the main bodies of the Scouts and both the Northern and Southeastern Forces had landed with no opposition. Artillery pieces and their tractor prime movers landed, but got no further than 75 meters from the shore as the vehicles lost traction in the tundra mud and snow patches. The fire support would have to be from the beach area. A wide-tracked vehicle, such as an oversnow vehicle, would have avoided this problem.

Over the next five days, the attack by the Southeast force, spearheaded by the 17th Regiment required frontal assaults up the mountain pass in the open terrain, with devastating results. Finally, they dug positions in the snow and tundra and waited.

The supply situation became critical. Since all vehicles ashore had sunk in the mud, combat troops were withdrawn and required to carry supplies[11]. A supervised bearer system should have been included in the plan from the start, as the Alaska officers had warned.

On the first night after the Southeast Force set up defensive positions, the men, exhausted by the climb and their first combat, slept wherever they could, exposed to the elements. Many awoke with severe frostbite. In the morning, the fog lifted part way up the mountains, concealing the Japanese, but exposing the Americans, who had not had food delivered to them since landing. Japanese snipers kept movement by the Americans to a minimum[12].

The weather and terrain were already taking their toll. All during the first four days, the weather kept U.S. bombers and close support aircraft from either taking off or finding targets on Attu. The wounded at Massacre Bay had been lying in the wet and cold at unit aid stations for as long as 48 hours. Radio traffic was disrupted by static, not unusual in the northern regions, which interfered with command and control[13].

Nearly half of the Scouts on the western side of the island were casualties from frostbite, sickness, or wounds by the fourth day. If leaders did not constantly watch them, the men would not move around or change wet socks. One platoon from the Southeastern Force was cut off for four days, when they were hit by Japanese machinegun fire. When the platoon leader tried to get the men to maneuver, they were mentally numb with the cold and hunger and would not move. Finally, a squad leader got his men to take out the enemy gun[14]. The need for strong top-to-bottom leadership became apparent.

In view of the difficulties experienced by the 7th ashore, Admiral Kincaid, commander of forces in Alaska and the Aleutians, decided to relieve Major General Albert E. Brown, the 7th Division Commander. He replaced him with Major General Eugene M. Landrum, an experienced Alaska hand[15].

By the seventh day of the battle, the Americans had suffered 1,100 casualties, 500 of them cold injuries. As close air support elements could not get in because of weather, naval gunfire had to provide this support, rapidly depleting the fleet's ammunition. Ship-to-shore supply dwindled almost to nothing by the eighth day, as 90 of the original 93 landing craft had sunk, either striking reefs or swamping in the winds and storm-induced high surf. Ashore, the first attempts were begun by the engineers to build a road for the artillery and supplies. In the cold and rain, the Americans began to strip the dead Japanese bodies of their effective cold weather clothing, even though it created the risk of their being shot by friendly fire[16]. They found that they needed a means of identifying friend from foe when both dressed similarly against the cold.

On day twelve, some of the frontline battalions returned to the beach. There, leaders discovered that some of the men had not removed their boots in thirteen days, resulting in multiple foot and cold injuries. Small unit leaders should have been constantly checking to avoid this kind of neglect.

By day thirteen, the new division commander realized that vehicles would not be able to move the artillery forward. He ordered the artillery pieces as well as the 105mm shells, weighing 54 pounds each, moved forward by hand.

On day eighteen, with his original 2,600-man force reduced to 800 combat capable soldiers and 600 wounded, the Japanese commander ordered a night attack against the supplies of the 7th Division. The tactics were simple: charge, and keep charging until the American supplies were taken. Then, the Japanese force would retire to the hills and wait for the unsupplied Americans to either leave the island or starve". On the evening of 28 May, the Japanese commander killed or ordered the suicide of all of his wounded and assembled for his final attack. When the attack began, it penetrated a weak sector. Some engineers with small arms, bayonets, and grenades finally stopped it. At that point, the 500 remaining Japanese committed mass suicide with grenades, thus ending the battle to retake Attu".

The battle for Attu was second only to Iwo Jima as the most costly American battle in the Pacific, considering the casualties as a percentage of the total forces employed. Of the estimated 14,000 men ashore at Attu, the unit suffered 549 killed, 1,148 wounded, 614 suffering from disease including exposure, 318 other casualties less cold injuries, and 1,200 severe cold injuries. The enormous loss of combat power due to cold injuries caused a massive study by the Surgeon General's office before the invasion of Italy, and the immediate acquisition of new footwear, clothing, tents, bedrolls, and rations.

The reports from Attu saved hundreds of American lives in the months to come, but this was small comfort to the hundreds of Attu veterans who underwent amputation of frostbitten limbs". They had simply confronted a better equipped enemy on Attu. As early as 1933, the Japanese had issued their soldiers knee-high boots made of leather and felt. The felt lining was heavy enough to trap warm air to keep the feet warm. The undersoles were rubber, molded in a corrugated design to allow for easier foot movement across icy surfaces. All Japanese soldiers received two sets of wool insoles, which they changed regularly to allow them to

dry. To protect their hands, they received mittens lined with sheep wool and goat hair extending from the cuffs all the way to the fingertips[20].

A major conclusion drawn from the battle was that the ground force commander cannot always count on air power in cold regions for several reasons. The visibility at an airfield could change from 5,000 feet to completely fogged in within six minutes. The winds were so high on most days that bombing runs took six hours to the target and only two hours back. The cold effects on the aircraft and crews caused difficulties in operation and maintenance[21]. Along with temperature effects, high winds wreaked havoc. They often reached wind speeds as high as 140 miles per hour. There were 174 aircraft lost in the Eleventh Air Force due to weather and mechanical problems, compared to only 40 lost in combat. The Navy Fleet Air Wing lost 35 aircraft to bad weather, compared to only 16 in combat. The Japanese suffered too, with as many as 200 aircraft lost in storms and fog, compared to 69 lost in action. These effects of the weather on air operations in the Aleutia[illegible]rt the ground troops with the correct impression that one simply could not rely [illegible]ir support[22].

The other major lessons learned poi[illegible]d to the obvious needs for proper individual training, equipment, force structure, and doctrine for conducting operations in cold regions.

VI - POSTWAR U.S. ARMY COLD WEATHER DOCTRINAL DEVELOPMENT

General

The U.S. Army became concerned about cold weather warfare in the early stages of WW II. U.S. Army doctrine developers had noted the impressive performance of the Finns in their war with the U.S.S.R. They looked at the need for units trained for operations in mountains and the cold[1].

At the end of the war, the Army War College posed a series of questions to a group of German general officers, all of which had fought in the U.S.S.R. during winter. The questions dealt with requirements for successful large scale winter operations in the cold. The respondents indicated the primary requirements as: equipment designed to withstand the cold; trained, acclimatized soldiers; exceptionally determined and physically fit officers of all ranks; fully mobile combat and supply vehicles, capable of cross-country movement in deep snow and

mud; suitable rations; technical facilities hardened against the cold; and a thoroughly prepared air force[3].

A variety of agencies established during and after WW II have contributed to the Army's current ability to wage war in the cold. Brief histories, roles, and missions follow on the major agencies.

Historical Accounts Of Major Army Agencies Dealing With Cold Weather Issues

U.S. Army Northern Warfare Training Center - NWTC

The U.S. Army Arctic Indoctrination Center formed in the winter of 1948-49, at Big Delta, Alaska. Its original mission was to train combat arms and services officers in basic Arctic operations. It oriented on terrain, weather, survival, logistics, and small unit operations[3].

In 1951, the Combined-Joint Committee on Arctic Operations, meeting at Fort Leavenworth, recommended the Arctic Indoctrination Center as the single-source proponent agent for Arctic operations. The center would be the proponent for several activities: development and supervision of long-range programs for the Arctic; development and testing of doctrine; establishment of requirements for developing Arctic materiel and supervision of testing; publication and maintenance of institutional memory of written material pertinent to Arctic operations; preparation of individual and unit training programs; development of force structures for units which were tasked for or likely to operate in cold regions; and coordination with sister services in Arctic tactical research and development[4].

In 1957, the U.S. Army Arctic Indoctrination Center also received the cold weather and mountain training mission previously performed at Camp Hale, Colorado since September 1942[5]. Special emphasis was placed on developing individuals qualified to perform as instructors. With the acceptance of these missions, the school's name became the U.S. Army Cold Weather and Mountain School (CWMS). The school still retained its original mission, but proponency for Arctic matters soon changed hands[6].

Beginning in mid-1962, the U.S. Army Combat Developments Command formed and absorbed the U.S. Army, Alaska (USARAL) Combat Developments (CD) office, which will be covered later in this chapter. The USARAL CD office reported that on 25 September 1962, the doctrinal proponency for both northern and mountain operations had moved from the U.S. Army Cold Weather and Mountain School to

Combat Developments Agency, Alaska (CDA (AK)), the new name for the USARAL CD office[7].

In 1963, the CWMS was redesignated the U.S. Army Northern Warfare Training Center (NWTC), with emphasis on training cadre members for units operating in the cold regions. Today, NWTC trains cadre members for units and agencies with missions or interests in cold weather warfare. It trains company-sized units and sometimes assists battalion-size units in conducting environmental training in Alaska. NWTC is staffed for training only and does not have enough personnel to manage proponency for cold weather warfare doctrine.

LTC Sheehan, commandant of the NWTC in 1967, recommended that U.S. Continental Army Command (USCONARC) Regular Army officers and NCOs attend NWTC on an individual basis. They could then take the basic cold weather skills back to their CONUS-based units. He recommended special selection and assignment of soldiers trained to fight and survive in the cold and mountainous regions[8].

Cold Regions Research and Engineering Laboratory - CRREL

WW II saw requirements for U.S. Forces to build airfields and facilities in areas with permafrost and snow. The Frost Effects Laboratory (FEL), established in Boston, August 1944, coordinated studies on how to analyze these types of terrain, execute effective construction on them, and conduct mobility over them. In February 1945, FEL established the Alaska Field Station near Fairbanks to conduct tests. In 1953, combining several investigative agencies of the Corps of Engineers, the Army established the Arctic Construction and Frost Effects Laboratory (ACFEL). In 1961, restructuring of the efforts of ACFEL and another agency produced the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL). CRREL moved from the Corps of Engineers to the Army Materiel Command in July 1962. CRREL's primary mission involves studies of snow, ice, and frozen ground, and the engineering aspects of construction and mobility in these conditions[9]. The narrow focus of its mission prevents CRREL from being the proponent agent for cold weather doctrine, but it can perform special studies in support of doctrine development.

U.S. Army Cold Regions Test Center - CRTC

CRTC originally formed in the early 1940s at Big Delta, Alaska, as the Army Arctic Test Branch. This facility belonged to the Chief, Army Field Forces, then to USCONARC. Later, when Training and Doctrine Command (TRADOC) and Army Materiel Command (AMC) formed, AMC assumed control of the center, now referred to as the U.S. Army Arctic Test Center. In the early 1970s, the center became the U.S. Army Cold Regions Test Center. Throughout these changes, it retained the mission to perform engineering design tests, feasibility tests, developmental tests, and initial production model tests. Supposedly, all materiel developed by and for the U.S. Army and not intended solely for desert, tropical, or temperate climates is tested there. While CRTC provides excellent insights for the Army in the area of cold effects on materiel, its charter as part of AMC limits its capability for doctrinal developments.

Combined Arms Center Liaison Office (Alaska) - CAC LO (AK)

As early as 1952, USCONARC bestowed proponency for Arctic warfare to USARAL. By 1955, USCONARC had also granted proponency for Arctic doctrine and Arctic Field Manuals to USARAL. In June of 1956, CONARC endorsed USARAL's request for establishing a Combat Development (CD) Section, with the missions to: oversee the testing of tactics, techniques, and doctrine; recommend modifications to the force structure to suit operations in cold regions; review and analyze the family of Arctic field manuals; determine military characteristics required of Army equipment; determine the environmental effects of the Arctic on personnel; report annually on the Army's ability to conduct arctic warfare; examine supply requirements for operations in cold regions; determine unique requirements for arctic airborne operations; and explore improvements in cross-country movement of troops and equipment. These functions were performed through coordination with the Army Arctic Indoctrination Center (later called NWTC)[9]. Additionally, the new Combat Developments office coordinated testing of equipment with the Army Field Forces' Arctic Test Branch (later called CRTC)[9].

As explained in the NWTC section, the U.S. Army Combat Developments Command absorbed the USARAL Combat Developments office in mid-1962. Doctrinal proponency for both northern and mountain operations moved from the CWMS to the Combat Developments Agency (Alaska), (CDA(AK)), the new name for the CD office[9].

In the area of doctrinal publications, the new CDA (AK) gained responsibility for maintaining and updating FM 31-70, *Basic Cold Weather Manual;* FM 31-71, *Northern Operations;* and FM 31-72, *Mountain Operations*[12]. In early 1963, the CDA (AK) reviewed TOEs in order to establish northern operations and mountain operations annexes. They coordinated troop tests of clothing and equipment in the cold regions. In this way, a recognized agency had active proponency and authority to act on matters involving doctrine development, testing, training, and after action reports of exercises. Because of this, the Army read their reports and applied the lessons learned from them[13].

In the late 1970s, the Combined Arms Center absorbed CDA(AK) and renamed it the Combined Arms Center Liaison Office (Alaska). The office lost its responsibility and authority as the *one clearing house* of doctrine and combat developments for cold regions. That responsibility now resides at Fort Leavenworth, Kansas. Today, the Alaska office conducts liaison with the agencies in Alaska, most notably the 6th Infantry Division (Light), NWTC, and CRTC. It is the most suitable agency available to serve as the proponent agency for cold weather doctrine.

Committees

Since World War II, there have been a number of committees concerned with combat developments, doctrine, and combat operations in cold regions. One of the first postwar committees was formed at Fort Leavenworth in the late 1940s or early 1950s, calling itself the Combined-Joint Committee on Arctic Operations. In 1951, it issued its recommendations on proponency issues. The Army Arctic Indoctrination Center, the committee stated, would be the proponent for several activities, as indicated previously in the section on NWTC[14]. The committee, however, identified its own structure as a major hindrance. The committee was *ad hoc*, with no priorities or precedence concerning members' daily duties. No fund cites were established for defraying telephone and telegraph costs nor was any money allocated for travel. Consequently, this burdened the Command and General Staff College faculty and resources. In order to solve these difficulties, the committee recommended the following: membership for any such committee or agency in the future be the primary duty of each member; the committee assemble in one location and remain in session until all issues are addressed; the Army allocate funds for travel, long-distance communications, mail, and civilian regular

and overtime pay; the Army grant direct coordination authority between pertinent agencies; and that the personnel system support the assignment and tracking of those service members with the expertise in operations in cold regions. They further recommended their own disbandment[15].

A similar committee formed in the mid-1950s in Alaska. The Arctic Guidance Board, as it was called, was a non-standing committee consisting of officers assigned to key positions within USARAL. The Board met once a month, but could not tackle the difficult issues, as the members, due to demands of their regular duties, could not concentrate on doctrinal items to the extent required[16]. Thus, this committee also folded.

In November 1976, a Cold Weather Materiel Requirements Conference convened at the U.S. Army Combined Arms Center at Fort Leavenworth. The stated purpose of the conference was to "identify and synthesize the materiel development and acquisition problems resulting from requirements for capabilities to operate in cold weather and to provide or confirm recommended solutions"[17]. Once convened, though, the conference began to address some of the problems in developments of stocks and equipment available for U.S. Forces Most of these stocks were geared for operations in Southeast Asia. Because of perceived overlap of responsibilities between CDA (AK) and the various proponent TRADOC schools, the conference concluded that TRADOC publish a new policy directive. This policy would emphasize the *proponent TRADOC schools* as having responsibility for establishing *requirements* for operation, storage, and transport of materiel in cold weather (AR 70-38), *not* the agencies assigned to and working in the cold[18].

The committee addressed 12 critical materiel problems. They recommended consideration, in 10 of the 12 cases, for improvements or studies of *existing* equipment or materiel primarily by Army Materiel Command agencies. The other two cases involved acquisition of off-the-shelf items already available or development of requirements for acquisition of new items. In the 10 cases not involving new items, the thinking focused on money savings and forcing of old systems, not previously suited for operations at lower temperatures, to meet new requirements using winterization kits or adaptations[19]. They believed that the kit system was the only cost effective means, since "relatively small quantities [of Army materiel are] required for cold weather employment"[20].

In 1981, NWTC voiced the opinion that the Cold Weather Materiel Readiness Conference held in 1976 at Fort Leavenworth had brought no noticeable results. They discussed the *ad hoc* Winter Warfare Committee formed in 1976 at CRREL which had evolved into the Winter Warfare Board, but which had not met as of 1981. The NWTC opinion was: "We must stop examining the problems, and start doing something about them"[21]. They recommended that MILPERCEN develop a system to track NWTC-trained personnel in a manner similar to master gunners in MILPERCEN's Armor Branch. Additionally, too many units were cancelling training during extremely cold periods, rather than continuing to train in the face of the extremes, while taking care to apply common sense. They voiced concern that FM 90-11, the long-awaited cold weather doctrine manual, was still not published. CDA (AK) cutbacks left no one with the primary doctrinal mission for cold weather warfare. Too much equipment was not being tested in the cold. They also recommended FORSCOM proponency for cold weather warfare doctrine in place of TRADOC[22].

In 1985, Commander, TRADOC, took over from CRREL the *ad hoc* Winter Warfare Board's responsibilities. TRADOC wrote a draft regulation establishing a new Winter Warfare Board. The Deputy Chief of Staff for Operations and Plans at Department of the Army, however, disapproved the Board's establishment[23].

In February 1987, the Commanding General, TRADOC, assigned the responsibility of identifying and overcoming deficiencies in U.S. Army doctrine and materiel designed for operations in cold regions to the Combined Arms Center at Fort Leavenworth. In August 1987, the Commander, Combined Arms Center and Fort Leavenworth (USACAC&FL), assigned the Combined Arms Combat Developments Activity (CACDA) as the primary activity in the establishment of a Northern Operations Working Party (NOWP). CACDA further assigned the Combined Arms Integration Directorate (CAID) as the Executive Agent in developing a plan for resolving cold regions issues[24]. This was fortunate, as the Director, CAID, had commanded an artillery battalion in Alaska. The unfortunate aspect was that TRADOC allocated no additional personnel or funds. Thus, the NOWP was begun in 1987 in much the same manner as the Arctic Warfare Committee had been in 1951, with part-time members, no funds, and no real teeth.

Today, the Army has no real proponent agent in the field for cold weather warfare doctrine with the necessary funds, personnel, and authority.

VII - CONCLUSIONS AND IMPLICATIONS

The pattern of U.S. Army combat developments since WW II has avoided, overlooked, or simply forgotten many of the requirements for combat readiness in cold regions. Several conclusions about combat readiness in that arena drawn by this author and their implicatior ıppear below. They have been separated into the categories of materiel, personnel, force structure, doctrine, and leadership.

Materiel

Mobility, a major area of concern for combat forces, requires reliable equipment and vehicles. The Army must design them in accordance with specific environmental criteria. Unfortunately, the Army develops its materiel around gross climatic and terrain conditions for likely areas of employment, rather than around specific requirements[1]. There exists in the Army today an example of an item designed specifically for the cold which is proving its worth. In the mid-1980s, the Army bought the BV-206 Small Unit Support Vehicle (SUSV) for units stationed in Alaska. Soon, the Army will purchase more of these SUSVs from Sweden. These should benefit both the units in Alaska and units with cold regions deployment contingencies.

Success in the cold requires equipment specifically designed for operations in the cold. AR 70-38, however, only requires "standard general purpose materiel...designed for...effective use under specified conditions of the basic climatic design type"[8]. This means that standard equipment must operate without requirement for add-on kits from +110°F down to only -25°F. Any items for use in colder temperatures may either be special items capable of, or solely designed for, such use. Developers may modify standard items to meet these extremes by using modification kits. Usually, the least expensive and most popular method of procurement of equipment for use in cold regions involves the Modification Kit approach[9].

If the Army desires that a system satisfactorily perform, and is maintainable and supportable in the cold, then it must require this from the materiel developers. This means *designing* the system to perform at temperatures as low as -50°F. Add-on kits have proven to be ineffective and cumbersome. Unfortunately, the Army has decided to take the risk associated with this aspect of materiel development in order to save on development costs[4]. These costs will

probably be more than offset by the savings down the line if developers design the system to perform properly in the cold from the start. Additionally, there is the unquantifiable cost savings associated with a soldier's survival.

There are gaps in the Army Regulation (AR) 70-38. As noted in the first chapter, there are 10°F temperature gaps between the defined cold temperature ranges recognized by the Army. These inconsistencies can only confuse developers unless the Army corrects them.

Technology can be applied in the development of basic troop care and hygiene items. For example, providing adequate drinking water is a recurring problem on exercises and deployments. Units cannot simply melt snow, as this wastes more fuel than the effort is worth. Alternate methods include drilling through ice over a body of water and pumping out and purifying the water from underneath[6]. The Army should purchase an inexpensive ice augur, or drill, for units with missions in cold regions.

Personnel

Care In The Cold

A shelter and warming plan for soldiers operating in the cold is essential for conducting sustained operations. Leaders must include these plans as part of operational planning. In Alaska, units normally rotate men into warm-up shelters every four hours. The Finns did this every two hours during the Russo-Finnish War[8]. Several different conclusions may be drawn. The Army can stay with the 10-man Arctic tent and ahkio sled group for squads and teams. They can also opt for lighter configurations, such as the 3-man *pulk* sled group, used in Sweden, for special operations forces. Finally, they could settle on a reasonable mixture of the two systems. This would offer the unit the opportunity to determine the optimum load and distance plans, and warming frequencies required for operations.

Physical conditioning is the principal means of preparing soldiers to fight anywhere in the world. In the cold regions conditioning is critical if soldiers are to move cross-country over hostile terrain, carrying heavy loads. This is especially critical if, while wearing snowshoes or skis and heavy clothing, they are to be a vital fighting force upon arrival at their destination[7].

Shelter and physical conditioning will not be enough if the soldier does not eat properly in order to produce adequate body heat. For this reason, planners must include sufficient quantities and dietary mixes of rations in training and operational plans.

Personnel Management

Acquiring and managing personnel with proper training and skills and the maintenance of an institutional memory for cold weather warfare could prove invaluable in future conflicts. These could provide the continuity of readiness needed for combat in the cold. As John Sater, an analyst for the Arctic Institute of North America wrote:

> Continuity must be maintained in many...programs if those programs are to be of maximum value. Without the means of maintaining continuous programs it will not be possible to obtain the services of adequate numbers of sufficiently trained...people capable of solving problems of the Arctic[8].

Management of soldiers with special skills which apply to cold regions should begin with recruitment. As shown earlier, those who are trained in these skills should be individually managed and assigned to gain the maximum payoff for the Army. One method of doing this is designating regimental linkage between units in the 6th Infantry Division (Light), in Alaska, and the 10th Infantry Division (Light), in New York. It should be apparent to personnel managers that management of specially trained personnel would be a very cost-conscious step.

Force Structure

Each light infantry, air assault, and airborne battalion TOE should reflect a space for someone with the additional skill indicator of Northern Warfare Expert. This would not require an additional person, but would designated TOE slots for those soldiers in the units who have already received cold weather training.

The units with cold regions contingency missions should receive at least twenty-five SUSVs per division. fifteen for general transport, ten for medical evacuation, all located in the DISCOMs. This would ensure that these units are familiar with the requirements for operating and maintaining the SUSVs before actual deployment.

Doctrine

Training

The Army may not need specialized troop units specifically trained and organized for a particular environment, but it does need units which can adapt quickly to operations in those special environments[9]. One method of ensuring more rapid adaptation is the presence of unit cold weather cadre members, as indicated above.

Trailbreaking is an absolute must for training plans involving preparation for operating in cold regions. The majority of the force may not be properly trained in oversnow movement. The efforts of a trained few to break trail, however, can significantly enhance the ability of the unit to reach its objective without being too exhausted to execute its intended mission[10]. NWTC and units of the 6th Infantry Division (Light), 10th Mountain Division (Light), and 1st Special Operations Command must emphasize and practice this skill, as it may prove to be crucial if units are deployed in the snow-covered northland.

Low intensity conflict (LIC) operations are possible in cold regions. The winter aids counterguerrilla operations. Swamps freeze in the winter, facilitating the movement of regular combat units. Trails used by insurgents are easier to detect and lack of vegetation in the winter minimizes cover and concealment[11].

Support functions for independent combat forces in cold regions should be performed on an area support basis by a[illegible]d elements. Mobile facilities should be used for performing direct support func[illegible] Specific throughput should replace normal echeloning of supplies. Unit distrib[illegible]ion of supplies, often throughput to forward units and bypassing battalion trains, should be the norm rather than supply point distribution[12]. Modern major exercises in the cold regions should include this concept of command and control and support arrangements. It is not the normal method of doing business in the Army, but may prove invaluable for sustained combat operations in the cold environment.

The NWTC and the Army National Guard Mountaineering School in Vermont are powerful Army assets for increasing training readiness in mountain and cold regions operations. The Army National Guard Mountaineering School teaches units techniques for operating in mountainous terrain. The Northern Warfare Training Center at Fort Greely, Alaska, trains primarily light infantry units for combat in mountainous and cold regions environments. It also teaches an Assault Climbers

Course for advanced mountaineers and a course specially tailored for reconnaissance or scout elements[15]. Unit commanders who are serious about increasing their units' ability to conduct operations in the cold should actively seek to enroll as many of their soldiers as possible in courses taught by these schools. Commanders should make maximum use of the cadre of these schools if their units are deploying on training exercises to cold regions.

Doctrine Proponency

Cold weather doctrine requires an appropriate organization authorized to serve as *the* proponent agency. In March 1951, the CGSC-directed Combined-Joint Committee on Arctic Operations recommended that the Army establish an agency for this, to be called the U.S. Army Arctic Center, appointed as *the* central agency for doctrinal developments with respect to cold weather operations[16]. In 1977, Colonel Francis King recommended in an article in *Military Review* that the Army form such a center and call it the Northern Warfare Center. He recognized that for the organization to have any teeth it would need a command group. He felt that without this system, the cold weather aspects of military operations would continue to receive low priority, much to the detriment of the Army's readiness[17]. As shown previously, committees do not work when they have no direct vested interest in the issues, or when they have neither dedicated personnel nor funds for use in resolving the issues. In order to ensure that action is taken on shortfalls in the Army concerning cold regions doctrine, training, personnel, and materiel issues, the CAC LO (AK) should receive complete authority to supervise *all* cold-related doctrinal activities. This would include researching, coordinating directly with appropriate agencies, and publishing doctrinal literature to include field manuals. With this responsibility and authority, CAC LO (AK) should receive personnel allocations and specific funding for those items indicated. TRADOC should require its branch-proponent schools to seek CAC LO (AK)'s concurrence on cold-related matters, rather than the other way around. In that manner, items relating to cold regions will not be relegated to funding in the *out years* nor will they be tied up in lengthy staffing.

Concerning doctrinal publications, FM 31-70, *Basic Cold Weather Manual*; FM 31-71, *Northern Operations*; and FM 9-207, *Operation and Maintenance of Ordnance Materiel in Cold Weather (0° to -65°F)*, or their replacements, require immediate update and distribution. FM 90-11, supposedly replacing FM 31-71, has

been promised to the field since at least the early 1980's. The update process for this manual is not even scheduled to start until second quarter FY90[19]. Similarly, the start date for updating FM 31-70 is not until second quarter FY89[20]. TRADOC should update FM 9-207 and enhance it to serve as a logistics supplement to FM 90-11[18]. In 1984, CRTC attempted such an effort, and their excellent staffing draft of FM 9-207 is available from CRTC today[16].

Leadership

As John Sater, an analyst for the Arctic Institute of North America wrote:

> Success in the high Arctic is dependent upon near perfect performance of all weapons, materiel, and men. A high state of training, outstanding morale, and equipment well designed for arctic use are essential if even the simplest operation is to succeed. Therefore small, specialized, elite units of volunteers should be organized and held in readiness for special operations in the Arctic Basin...[and] be effective in the air, and on land, water, and ice.[16]

Selected U.S. Army light forces and special operations forces, presumably, are already earmarked for these regions. Leaders for these units require more thorough screening than those earmarked for other regions because of the unique leadership requirements for cold weather operations. Successful leaders in cold regions assignments should be considered for repeated tours in those areas.

The ability of soldiers to function optimally in cold regions is directly related to the weather, terrain conditions, physical condition of the troops, and their training, equipment, and leadership. The well-trained, well-led, and acclimatized Finns had no problem in moving great distances and sustaining their forces[21].

Summary

The Army needs a centrally-managed, detailed doctrine for conducting combat in cold regions. Doctrine should normally be general enough to remain suitably flexible for adapting to any given situation. The special requirements for operating in the cold necessitate more detailed doctrine than those for operating under other conditions. The maintenance of the Army's institutional memory for managing these details should be the responsibility of a single, suitably located and resourced agency. The most suitable agency for this function, in this author's opinion, is the Combined Arms Center Liaison Office (Alaska). CAC LO (AK) would require additional personnel, funding, and authority for semi-independent action in fulfilling this mission. The return on investment for this would be unquantifiable: the probability of saving many lives in cold weather combat.

There are deficiencies in the Army's definitions and doctrine for cold weather operations. Most glaring, there are 10°F temperature gaps in the definitions of operating temperature range requirements in the Army's primary regulation for development of equipment, AR 70-38. These should be amended, so that materiel developers will not be tempted to exploit inconsistencies in requirements and so that users will not expect too much from a system which has specific limitations.

There are other deficiencies in Army doctrine besides shortfalls in definitions. The existing series of cold weather doctrinal field manuals needs immediate update and issuance to the field. New technology and the concepts contained in the framework for AirLand Battle doctrine must be addressed with respect to combat operations and support in the cold.

Units planning to conduct combat operations or perform support in the cold, either because of current basing location or deployment contingencies, must remain ready for combat under the special conditions brought on by the cold. These units should train and specially manage selected individuals chosen as cold weather cadre for their units. They should attempt to conduct environmental unit training in cold regions whenever funds and time allow, taking advantage of the expertise of their own unit cadre and that of organizations such as the NWTC and the Army National Guard Mountaineering School. Further, they should seek to add supplemental tasks relating to cold weather operations to their Mission Essential Task Lists as part of their Battle Focus for training. Finally, they should inspect the contingency items stored for issue to them in the event of their deployment to cold regions; this will give them an idea of how well they will be supplied with essential equipment if they must deploy and fight in the cold.

Like the Finns, the U.S. Army has, in the past, demonstrated its potential to fight in the cold. The difficulties today lie simply with priorities. As more of the old soldiers who fought in the Appenines Mountains of Italy, on Attu, and around the Chosin Reservoir in Korea retire and pass away, the risk increases that their experiences will not be preserved for the Army's use. Now that these soldiers are no longer in the active force, the Army must return to the study of the cold effects throughout history or be forced to re-learn them through bitter struggle on some cold future battlefield.

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10. U.S. Army, Alaska, ARAGG-322, Letter, subject: Establishment of Combat Development Section in USARAL, 8 Jun 56, with Ind by USCONARC, ATSWD-322, 29 Jun 56.

11. *Ibid.*

12. U.S. Army, Alaska, ARACD, Letter, subject: USARAL Activities Report, 22 Oct 62.

13. U.S. Army, Alaska, ARACD, Letter, subject: USARAL Combat Developments Agency Activities Report, 25 April 1963.

14. U.S. Army Command and General Staff College, ALLER, Report, subject: Report of Combined-Joint Committee on Arctic Operations, with 1st Ind, ALLEB 461, 26 March 1951.

15. *Ibid.*

16. U.S. Army, Alaska, ARAGG-322, Letter, subject: Establishment of Combat Development Section in USARAL, 8 Jun 56, with Ind by USCONARC, ATSWD-322, 29 Jun 56.

17. U.S. Army Combined Arms Center, *Cold Weather Materiel Requirements Conference After Action Report*, (Fort Leavenworth: USACAC, 9 December 1976), pp. iii-iv.

18. *Ibid.*

19. *Ibid.*, pp.iv-vii.

20. *Ibid.*, p. 2

21. U.S. Army Northern Warfare Training Center, Draft Letter, subject: Shortfall in the Army Approach to Northern Operations, 1981.

22. *Ibid.*

23. U.S. Army Combined Arms Combat Developments Activity, ATZL-CAI-I, Report, subject: Combined Arms Center Northern Operations Action Plan, 23 September 1987, pp. 2-3. This was Enclosure 2 to a Memorandum distributed by the Combined Arms Integration Directorate, calling for the first meeting of the Northern Operations Working Party.

24. *Ibid.*, pp. 1-2.

NOTES ON CHAPTER VII

1. Sater, *op. cit.*, p. 1.

2. AR 70-38, pp. 1-3, 2-2.

3. *Ibid.*, p. 2-2.

4. CRTC, *op. cit.*, p. 58

5. Hammerman, *op. cit.*, pp. 17-18.

6. *Ibid.*, p. 23.

7. Cash, *op. cit.*, pp. 56-57.

8. Sater, *op. cit.*, p. 5.

9. Richmond, *op. cit.*, p. 71.

10. Cash, *op. cit.*, pp. 61-62.

11. U.S. Army, Alaska, ARACD, Letter, subject: USARAL Activities Report, 8 Aug 62, pp. 2-3.

12. U.S. Army, Alaska, ARACD, Report, subject: Logistic Support of the Battle Group in Northern Operations, USARAL 58-1 (Study Project 1601-58), 15 March 1962, pp. ii-iii.

13. Richmond, *op. cit.*, pp. 72-73.

14. U.S. Army Command and General Staff College, ALLER, Report, subject: Report of Combined-Joint Committee on Arctic Operations, with 1st Ind, ALLEB 461, 26 March 1951.

15. Col. Francis King, "Cold Weather Warfare: What Would Happen?", *Military Review*, (November 1977), pp. 94-95.

16. U.S. Army Combined Arms Combat Developments Activity, ATZL-CAI-I, Report, subject: Combined Arms Center Northern Operations Action Plan, 23 September 1987, p. 5.

17. *Ibid.*, p. 6.

18. *Ibid.*, pp. 7-8.

19. The staffing draft of Field Manual (FM) 9-207 (Draft) was published by CRTC in response to a request from the U.S. Army Combined Arms Center in 1984. Since that time, no action has been taken to publish the updated FM in final form for distribution to the Army as a whole. USACAC passed the action to the U.S. Army Ordnance Center and School at Aberdeen Proving Ground, MD, where no final action is planned until FY89.

20. Sater, *op. cit.*, p. 10.

21. Hammerman, *op. cit.*, pp. 24-25.

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